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FOOD IN WAR TIME¹

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THERE is no doubt that under the conditions existing before the war the American people lived in a higher degree of comfort than that enjoyed in Europe. Hard times in America have always been better times than the best times in Europe. As a student in Munich in 1890 I remember paying three dollars a month for my room, five cents daily for my breakfast consisting of coffee and a roll without butter, and thirty-five cents for a four-course dinner at a fashionable restaurant. This does not sound extravagant, but it represents luxury when compared with the diet of the poorest Italian peasants of southern Italy. Two Italian scientists describe how this class of people live mainly on cornmeal, olive oil and green stuffs and have done so for generations. There is no milk, cheese or eggs in their dietary. Meat in the form of fat pork is taken three or four times a year. Cornmeal is taken as "polenta," or is mixed with beans and oil, or is made into corn bread. Cabbage or the leaves of beets are boiled in water and then eaten with oil flavored with garlic or Spanish pepper. One of the families investigated consisted of eight individuals, of whom two were children. The annual income was 424 francs or \$84. Of this three cents per day per adult was spent for food and the remaining three fifths of a cent was spent for other purposes. Little wonder that such people have migrated to America, but it may strike some as astonishing that a race so nourished should have become the man power in the construction of our railways, our subways and our great buildings.

Dr. McCollum will tell you that the secret of it all lies in the green leaves. The quality of the protein in corn is poor but the protein in the leaves supplements that of corn so that a good result is obtained. Olive oil when taken alone is a poor fat in a nutritive sense, but when taken with green leaves these furnish that one of the peculiar accessory substances, commonly known as vitamins, which is present most abundantly in butter fat, and gives to butter fat and to the fat in whole milk its dominant nutritive value. The green leaves also fur-

¹ An address prepared at the request of the U. S. Food Administration.

nish another accessory substance which is soluble in water and which is necessary for normal life. Furthermore the green leaves contain mineral matter in considerable quantity and in about the same proportions as they exist in milk.

Here then is the message of economy in diet, corn the cheapest of all the cereals, a vegetable oil cheaper by far than animal fat, which two materials taken together would bring disaster upon the human race, but if taken with the addition of cabbage or beet tops they become capable of maintaining mankind from generation to generation. One can safely refer to such a diet as a balanced diet.

This preliminary sketch shows several important fundamentals of food and nutrition. If one gives an animal a mixture of purified food stuffs, pure protein, pure starch, purified fat, and a mixture of salts like the salts of milk, the animal will surely die. But if one substitutes butter fat for purified fat, and adds a water solution of the natural salts of milk, the animal lives and thrives.

Again the illustration shows how corn may be so supplemented with other food-stuffs as to become extremely valuable in nutrition. It is especially valuable at the present time because corn is comparatively cheap and plentiful. But one asks how about pellagra? It must be here definitely stated that the use of cornmeal is not the cause of pellagra provided the right kind of other foods be taken with it. Pellagra occurs in the "corn belt" of the United States, and especially among the poorer classes in the south. The disease has developed since the introduction in 1880 of highly perfected milling machinery which furnishes corn and wheat completely freed from their outer coverings. In Italy, where the milling of corn is still primitive, pellagra is not as severe as with us, because the corn offal is not completely removed and this contains the accessory food substances or vitamins which are essential to life. Pellagra is generally believed to be produced by a too exclusive use of highly milled corn and wheat flour in association with salt meats and canned goods, all of which are deficient in vitamins. The administration of fresh milk is naturally indicated. Goldberger states that after the addition of milk to the diet of a pellagrins, the typical clinical picture of pellagra no longer persists. The poor in the mill towns of the South lived too exclusively upon a corn diet without admixture of milk or fresh animal food or even of cabbage and pellagra has been the consequence.

The Food Administrator asks us to eat corn bread and save the wheat for export. It is a very small sacrifice to eat corn

bread at one meal or more a day. Indian corn saved our New England ancestors from starvation, and we can in part substitute it for our wheat and send the latter abroad to spare others from starvation. The simplest elements of patriotism demand that we do this. Therefore let us cry "Eat corn bread and save the wheat for France, the home of Lafayette!"

Another point in war economy is the use of whole milk in greater quantity, and the diminution of the use of butter and cream. Cream is bought only by the wealthy, but in sufficient volume to largely reduce the amount of whole milk available. In Germany before the war 15 per cent. of the milk supply of that country was used for the production of cream. Regarding the use of butter a Swiss professor, himself an expert in nutrition, complains that whereas in his youth children were never given butter on their bread for breakfast, not even when there was no jam in the house, yet to-day absence of butter from the table is held to be indicative of direst poverty.

If one takes a pint of whole milk daily, or even, as we have seen, cabbage or beet tops in its stead, one may take fat in the forms of oleomargarine, olive oil or cotton-seed oil without possible prejudice to health. The legal restrictions placed upon the sale of oleomargarine and the taxes enhancing its cost, now in operation in many of our states, are without warrant in morals or common sense and should be entirely abolished in times like these. A well-made brand of oleomargarine is much more palatable than butter of the second grade, and certainly for cooking purposes is just as valuable.

Whole milk contains everything necessary for growth and maintenance, protein, fat, milk-sugar, salts, water and the unknown but invaluable accessory substances. It is of such prime importance that each family should have this admirable food, that I have suggested that no family of five should ever buy meat until they have bought three quarts of milk. The insistence by scientific men upon the prime importance of milk has probably had something to do with its rapid enhancement in price. This latter factor is greatly to be regretted. I have often wondered why it was that a quart bottle of a fancy brand of milk in New York should cost about as much as a quart of *vin ordinaire* on the streets of Paris, and a quart bottle of cream as much as a quart of good champagne in Paris. Despite much denial it appears to me that milk is not sold as cheaply as it ought to be. Everything should be done to conserve our herds of cows for the increased supply of whole milk and incidentally for the manufacture of cheese and of milk powder or of condensed milk.

If one takes milk with other foods meat may be dispensed with. Thus Hindhede advocates as ideal a diet consisting of bread, potatoes, fruit and a pint of milk. Splendid health, both of body and mind, the peasants' comparative immunity to indigestion, kidney and liver disease, as well as an absolute immunity to gout, is the alluring prospect held out by the following dietary:

Graham bread	1 lb.
Potatoes	2 lbs.
Vegetable fat	$\frac{1}{3}$ lb.
Apples	1 $\frac{1}{2}$ lbs.
Milk	1 pint.

This bread-potato-fruit diet gives a very excellent basis of wholesome nutrition. The potatoes yield an alkaline ash which has a highly solvent power over uric acid, and therefore a good supply of these valuable tubers is needed by the nation.

To most Americans the dietary factors here described will appear to be merely attenuated hypotheses, fit only for philosophic contemplation. For, in real life, it is the roast beef of Old England, or some other famed equivalent, that makes its appeal. Far be it from me to disparage the feast following a hunt of the wild boar or other feasts famed in song and story, but that is not the question. The question is, is meat necessary? The description of the Italian dietary answers this in the negative.

But is meat desirable? The Italian experimenters believed that the addition of 4 or 8 ounces of meat to the dietaries of some of their subjects increased their physical and also their mental powers. The increase in mental power due to change in diet has always seemed to me to be a figment of the imagination and not susceptible of demonstration. Thomas lived for 24 days on a diet of starch and cream, during 4 days of which time the very small quantity of 3 ounces of meat was taken daily, and he found his mental and muscular power unchanged.

A remarkable experiment on the effect of a potato diet has been reported by Hindhede. An individual partook of a diet of between 4 $\frac{1}{2}$ and 9 lbs. of potatoes daily with some vegetable margarine during a period of nearly three hundred days. The rule was to eat only when hungry and then the potatoes could be taken at the rate of an ounce a minute. During the last three months (95 days) of the experiment severe mechanical work was performed and the total food intake for the latter period amounted to 770 lbs. of potatoes and 48 lbs. of margarine. What could be more simple than stocking the cellar with coal,

potatoes and a tub of margarine! Who then would worry about the complexities of modern life?

Of course vegetarianism is no new thing. Its principal exponent was Sylvester Graham. It so happens that he was the brother of my great grandmother, and of him my father wrote in 1861 "long lanky Sylvester Vegetable Graham, leanest of men." Graham in 1829 began the advocacy of moderation in the use of a diet consisting of vegetables, Graham bread, fruits, nuts, salts and pure water, and excluding meat, sauces, salads, tea, coffee, alcohol, pepper and mustard. The first effect of this diet, which largely eliminated the flavors, was to reduce the weight through lowering the intake of food, but the health of many followers of the diet appears to have been benefited. The "Graham System" of dieting suffered from withering criticism at the time. He published in 1837 a little book entitled: "Bread and Bread Making," bearing on its cover the scriptural quotation "Bread strengtheneth man's heart." He says in this volume:

But while the people of our country are entirely given up as they are at present, to gross and promiscuous feeding on the dead carcasses of animals and to the untiring pursuit of wealth, it is perhaps wholly vain for a single individual to raise his voice on a subject of this kind.

The well-known work of Chittenden has shown that when the protein intake is reduced by one half or less of that which the average American appetite suggests, professional men, soldiers and athletes may be maintained in the best physical condition. One of Yale's champion intercollegiate athletes won all the events of the year in which he was entered while living on a reduced protein or Chittenden diet. Upon such a diet, or less than that, the people of Germany are now living to-day. The principle involves eating meat very sparingly, taking half a piece where one would have formerly been taken, and using it only for its flavor. The wing of a chicken has little meat on it and yet if eaten together with vegetables it gives the meal a different quality than it would have had without it, and to this extent its use is warranted. The muscles are active when hard labor is done, but the muscles do not need meat for the performance of their work. A fasting man may have considerable power. The popular idea of the necessity of meat for a laboring man may be epitomized in the statement: a strong man can eat more meat than a weak one, hence meat makes a man strong. The proposition is evidently absurd.

Indulgence in meat is due to the desire for strong flavor.

With the increased distribution of wealth, the demand for meat grows. Its consumption by all classes had vastly increased in all prosperous countries prior to the war. It is well, however, to remember that its use has been excessive and unnecessary, and its price can be cut by wholesale voluntary abstinence. The British people have suffered no hardship in the recent reduction of their meat ration.

A British Commission has reported to Parliament that it takes three times as much fodder to produce beef as it does to produce milk or pork of the same food value. Since cows eat chiefly hay and grass and pigs eat grain the cost of the production of a unit value of milk is much less than the cost of the same value in the form of pork. It takes only fifty per cent. more fodder to produce veal than to produce pork. Milk, pork and veal have long been the established protein-containing foods of nations on the continent of Europe. According to these figures beef should cost in the market twice what veal costs, and yet the butcher charges nearly the same for the two. It would save food for milk production if steers were eaten as veal and not fed up into beef cattle. If all heifers were developed into milch cows and no cow capable of giving milk in quantity were slaughtered, the country would be placed on a much better basis than at present. It would make beef expensive, but there is every reason why it should be expensive. It would increase the dairy business, which is evidently a need of the times, something for the protection of the welfare of mankind. For it must be remembered that a well-nourished cow during a single year will give in the form of milk as much protein and two and a half times the number of calories as are contained in her own body.

This was written before the publication of the following words of Armsby, the foremost authority on animal nutrition:²

Roast pig, to those who like it, is not only a delicacy but a valuable article of diet, but nevertheless, it is possible to pay too high a price for it, and while a proposal to restrict rather than to promote meat production in the present crisis may appear both irrational and unpatriotic it may nevertheless be in the interest of true food economy. . . .

It may be roughly estimated that about 24 per cent. of the energy of grain is recovered for human consumption in pork, about 18 per cent. in milk and only about 3.5 per cent. in beef and mutton. In other words, the farmer who feeds bread grains to his stock is burning up 75 to 97 per cent. of them in order to produce for us a small residue of roast pig, and so is diminishing the total stock of human food. . . .

The task of the stock feeder must be to utilize through his skill and knowledge the inedible products of the farm and factory such as hay, corn

² "Roast Pig," *Science*, 1917, XLVI., 160.

stalks, straw, bran, brewers' and distillers' grains, gluten feed, and the like, and to make at least a fraction of them available for man's use. In so doing he will be really adding to the food supply and will be rendering a great public service. Rather than seek to stimulate live stock husbandry the ideal should be to adjust it to the limits set by the available supply of forage crops and by-product feeding stuffs while, on the other hand, utilizing these to the greatest practicable extent, because in this way we save some of what would otherwise be a total loss. . . .

The hog is the great competitor of man for the higher grades of food and in swine husbandry as ordinarily conducted we are in danger of paying too much for our roast pig. Cattle and sheep, on the other hand, although less efficient as converters, can utilize products which man can not use and save some of their potential value as human food. From this point of view, as well as on account of the importance of milk to infants and invalids, the high economy of food production by the dairy cow deserves careful consideration, although of course the large labor requirement is a counterbalancing factor.

At any rate, it is clear that at the present time enthusiastic but ill-considered "booming" of live stock production may do more harm than good. If it is desirable to restrict or prohibit the production of alcohol from grain or potatoes on the ground that it involves a waste of food value, the same reason calls for restriction of the burning-up of these materials to produce roast pig. This means, of course, a limited meat supply. To some of us this may seem a hardship. Meat, however, is by no means the essential that we have been wont to suppose and partial deprivation of it is not inconsistent with high bodily efficiency. Certainly no patriotic citizen would wish to insist on his customary allowance of roast pig at the cost of the food supply of his brothers in the trenches.

Heat from the sun enters into the composition of the food substances when they are being built up in the plants, and this energy, which is latent in the food, is set free in the animal body and is used as the source of power behind all the physical activities of the body. The energy can all be recovered as heat and measured in the form of calories. According to the principles of the law of the conservation of energy, heat is not destructible. The understanding of the value of a calorie is indispensable for the comprehension of nutrition. A calorie is the measure of a unit of heat, or the quantity of heat necessary to raise a liter of water from 0° to 1° Centigrade. Apparatus has been invented for measuring the heat production of a man, an apparatus which is called a calorimeter or a measurer of calories. If one puts a man weighing, say, 156 pounds in the box of such an apparatus, so that he lies comfortably on a bed in complete muscular relaxation, and before his breakfast, one finds that he produces 70 calories an hour. Only in certain types of disease is there any variation from this normal, though of course the weight of the man makes a difference in his requirement for energy. If, at the same time the subject is in

the box, the quantity of oxygen which he absorbs is measured and if certain other chemical analyses be carried out, one can calculate the exact amounts of protein, fat, and sugar which have been oxidized by this oxygen. Now if one calculates how much heat ought to have been set free from the oxidation of these quantities of protein fat and carbohydrate, it is discovered that the heat which ought to have been produced is exactly that quantity which was measured as having been produced by the man. This measurement represents the *basal metabolism* of a man at complete rest, when his oxidative activities are at their lowest ebb.

The basal metabolism as measured by 70 calories per hour in the case of this individual represents the sum of the fuel needed (1) to maintain the beating of the heart, which every minute of a man's life moves the blood or one twentieth part of the weight of the body, in a circle through the blood vessels; (2) to maintain the muscles of respiration that the blood may be purified in the lungs; (3) to maintain the body temperature at that constant level which is so characteristic that a slight variation signifies illness, and (4) to maintain in the living state the numerous tissues of the body. Any extraneous muscular movements are carried out in virtue of an increased oxidation of materials and the heat production rises above the level of the basal metabolism with increased muscular effort. For a long time the power for the maintenance of the human machine can be furnished by its own body fat, as is seen in cases of prolonged fasting, but usually the power is derived instead from the food-fuel which is taken. The great question in the world to-day is whether or not a sufficient quantity of food-fuel is available to support the human family. The question of calories is not an academic one, but an intensely practical one.

The following values may be cited from the literature on the subject, as showing the daily requirement of energy for working people when the work day is of eight hours. A seamstress sewing with a needle required 1,800 calories. Two seamstresses using a sewing machine required 1,900 and 2,100 calories. Two women book-binders required 1,900 and 2,100 calories. Two household servants employed in such occupations as cleaning windows and floors, scouring knives, forks and spoons, scouring copper and iron pots required 2,300 to 2,900 calories. Two washerwomen, the same servants as last named, required 2,600 to 3,400 calories in fulfilment of their daily work.

Concerning the fuel requirement for the occupations of men: Two tailors required 2,400 and 2,500 calories. A book-binder required 2,700 and a shoemaker 2,800. Two metal workers filing and hammering metals required 3,100 and 3,200 calories. Two painters occupied in painting furniture required 3,200 and 3,300 calories and two carpenters engaged in making tables required the same amount of energy. Farmers of all nationalities—United States, Mexico, Italy, Finland—required 3,500 calories. Two stonemasons chiseling a tombstone required 4,300 and 4,700. Two men sawing wood needed 5,000 and 5,400 calories.

Other studies upon the requirements of lumbermen engaged in chopping and yarding logs, bicycle riders in six-day bicycle races and men engaged in long mountaineering ascents show that the demand for food-fuel may reach 10,000 calories daily.

It is evident from this analysis that whenever there is physical labor to be accomplished the demand for food-fuel increases. The present world food situation depends not only on a short wheat crop, but also upon the fact of an increased demand for food-fuel on account of an increased speeding up of the human machines, which latter factor includes a largely increased amount of muscular work done by women.

A British scientific commission has reported to Parliament that if the workman be undernourished he may by grit and pluck continue his labor for a certain time, but in the end his work is sure to fail. It makes no difference what the nutritive condition of the person is, if a certain job involving muscular effort is to be done it always requires a definite amount of extra food-fuel to do it. Rubner, the greatest German authority on nutrition, excited grossly inappropriate hilarity in the comic press of his country, by showing that a poor woman who waited several hours in line in order to receive the dole of fat allowed her by the government, actually consumed more of her own body fat in the effort of standing during those hours than she obtained in the fat given her when her turn to receive it came at last.

A method by which food-fuel can readily be saved with benefit to the nation and to the individual is for the over-fat to reduce their weight. This has been done with drastic severity in Germany. I have heard from unquestioned sources how a man who had weighed 240 pounds lost 90 pounds since the war began; how a corpulent professor at Breslau lost greatly in weight, but during the second summer of the war regained

his former corpulence during a sojourn in the Bavarian Tyrol, a joy not now tolerated; and how an American woman lost 40 pounds in weight last winter in Dresden. There is every reason why a man who is over-weight at the age of fifty should reduce his weight until he reaches the weight he was when he was thirty-five. According to Dr. Fiske he is a better insurance risk if after thirty-five he is under the weight which is the average for those of his years. Reduction in weight reduces the basal requirement for food, and reduces the amount of fuel needed for moving the body in walking. The most extreme illustration of the effect of emaciation upon the food requirement is afforded by a woman who after losing nearly half of her body weight was found to need only 40 per cent. of the food-fuel formerly required. This represented a state not far from the border line of death from starvation, but it indicates how a community may long support itself on restricted rations. It must be strictly borne in mind however that if any external muscular work is to be accomplished it can only be effected at the expense of a given added quantity of food-fuel, whether the person be fat or thin.

It is not at all difficult to reduce the body weight. Suppose a clergyman or a physician requires 2,500 calories daily in the accomplishment of his work and takes 2,580 calories per day instead. The additional 80 calories is the equivalent of a butter ball weighing a third of an ounce, or an ounce of bread or half a glass of milk. It would seem to be the height of absurdity to object to such a trifle. But if this excess in food intake be continued for a year the person will gain nine pounds and at the end of ten years ninety pounds. Such a person would find that he required a constantly increasing amount of food in order to transport his constantly increasing weight. In instances of this sort a motto may be applied which I heard the last time I was in Washington: "Do not stuff your husband, husband your stuff."

Now it is evident that, if instead of taking more than the required amount of food a little less be taken than is needed the balance of food-fuel must be obtained from the reserves of the body's own supply of fat. By cutting down the quantity of fat taken, or by eliminating a glass of beer or a drink of whiskey, and not compensating for the loss of these by adding other food stuffs, the weight may be gradually reduced. The amusing little book entitled "Eat and Grow Thin" recommends a high protein and almost carbohydrate-free diet for the accomplishment of this purpose, but its advice has made so many of

my friends so utterly miserable that I am sure that in the end it will counteract its own message.

The work of the world is accomplished in largest part by the oxidation of carbohydrates, that is to say of sugars and starches. Bread, corn, rice, macaroni, cane-sugar, these are *par excellence* the food-fuels of the human machine. They are all convertible into glucose in the body, which glucose gives power to the human machine. Fat may be used for the same purpose, but unless carbohydrate is also present a person can not work up to his fullest capacity.

As all the world is seeking for food-fuel with which to do work, I want to place before you a plea that the public be informed as regards the energy value of its purchases. It is but repetition of an already published statement.³

A barrel of flour weighs 196 pounds. One pound of flour yields 1,650 calories. One barrel of flour, therefore, contains 1,650 times 196, or 323,400, calories. The farmer in 1916 received \$1.50 a bushel for his wheat, which would make the barrel of flour cost about \$7.50. In February, 1917, the cost was \$9 a barrel, whereas in May of the same year it sold at retail at \$17 and more a barrel and in August the price had fallen slightly. These costs may thus be reckoned:

	Price Per Barrel of 323,400 Calories	Price Per 1,000 Calories
Flour, based on 1916 price of wheat		
paid to farmer	\$7.50	\$0.023
Flour, February, 1917	9.00	0.028
Flour at retail in New York, May		
22, 1917	17.12	0.053
August 27, 1917	15.29	0.048

Since one third of the food-fuel of America, England, and France is derived from flour, it is evident that the extortionate price exacted for bread, which has been called the staff of life, puts a severe load upon the human family and has placed under fire the modern machinery of food speculation which has made such prices possible.

Passing now to a consideration of the foods sold in packages, I bought at a department store on May 22 the following foods, at the following cost per thousand calories:

PRICE PER 1,000 CALORIES	
Cornmeal	3½ cents
Karo Corn Syrup	5½ cents
Wheatena	8 cents
Grape-Nuts	8½ cents

³ *World's Work*, August, 1917.

Sunshine Cheese Wafers	15	cents
Quaker Oats	4½	cents
Cream of Wheat	5½	cents
Corn Flakes	8½	cents
Animal Crackers	11½	cents
Nabisco Wafers	32	cents
Imperial Cheese	41	cents

I firmly believe that a great advance would be scored if the value in calories were placed on every food package sold.

As to the use of alcoholic beverages the question resolves itself into several factors. Alcohol gives a sham sensation of added force and in reality decreases the ability to do work. Alcohol is the greatest cause of misery in the world and as Cushny has put it, if alcohol had been a new synthetic drug introduced from Germany, its importation would long since have been forbidden. On the other hand good beer makes poor food taste well. It also frequently leads to overeating. The cure for bad food is to have our daughters taught how to cook a decent meal. After that we can talk about prohibition.

The food situation is probably more serious than most of us realize. The country should be stirred to a keener sense of its responsibilities. In conclusion, let us agree if we can to the following propositions:

1. Eat corn bread and save the wheat for France, the home of Lafayette, and for our other allies.
2. Let no family (of five persons) buy meat until it has bought three quarts of milk.
3. Save the cream and butter and eat vegetable oils and oleo-margarine.
4. Eat meat sparingly, rich and poor, laborer and indolent alike.
5. If fat, grow thin.
6. Be a prohibitionist for the period of the war (if you have enough resolution).
7. Save everything that can be used for food, because food is precious.
8. Finally remember that all the world is seeking for food-fuel with which to do work and that, though our wheat crop is short, still we are the nation most richly endowed with food-fuel. It remains to be seen whether we have the intelligence to fitly utilize for the welfare of mankind the resources which God and nature have placed in our hands.